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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/752,416	01/06/2004	David G. Mikolas	100116	3899

29050 7590 12/03/2004

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EXAMINER

NGUYEN, GEORGE BINH MINH

ART UNIT PAPER NUMBER

3723

DATE MAILED: 12/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/752,416

Applicant(s)

MIKOLAS ET AL.

Examiner

George Nguyen

Art Unit

3723

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: ____.

DETAILED ACTION

Receipt is acknowledged of the IDS filed on July 07, 2004 which has not been considered and placed of record in the file. See reasons for not considering the IDS below.

Claims 1-18 are presented for examination.

This application has been filed with informal drawings which are acceptable to the examiner.

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: reference number 40. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.
2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the specific limitations

of "preshaped asperities" in claim 11 and "bumps" in claim 12 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Information Disclosure Statement

3. The information disclosure statement filed July 07, 2004 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that

portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Specification

4. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: the subject matter of "a combination of chemical etch and mechanical polishing" set forth in claim 4 appears to have no support in the specification.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Claim 4 recites the limitation "chemical etch" and "mechanical polishing" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim.

In addition, in claim 11, there appears to be a typo error regarding to the word "be". It should have been "by". Correction is required.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

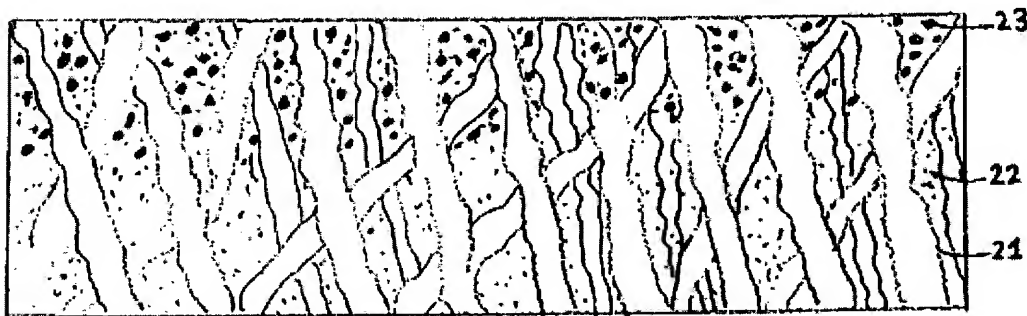
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(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

9. Claims 1, 2, 3, 4, 5, 6, and 7 are rejected under 35 U.S.C. 102(a) as being anticipated by Baker et al.'6,626,740.

With reference to Figure 2, col. 2, 3 and 8 as shown below discloses the claimed invention. Regarding to claim 4, as well as understood, Baker method comprises a combination of chemical and mechanical polishing. Please note that the prior art "dub-off" (col. 10, lines 15-20) is interpreted as "corner rounding". Furthermore, the prior art inherently teaches the "selectively polishing" in order to achieve the improved "dub-off".

FIGURE 2A



Hardness or compression modulus of the polishing pad is a measure of the degree to which the pad material deforms when subjected to pressure or downforce during CMP. Hard polishing pads generally yield a polished substrate surface with good planarization and low form error. However, hard polishing pads also scratch the substrate surface and result in a polished substrate surface of poor quality. Soft polishing pads, such as poromeric pads, and "foam" type pads, generally exhibit excellent surface finish with low levels of scratching, low roughness and good removal rates. However, soft polishing pads result in poor planarization and high waviness of the polished substrate surface. The present invention combines desirable characteristics of hard and soft polishing pads resulting in a finished polished substrate surface with low roughness, low waviness, low dub-off and minimal scratching.

The pad of this invention comprises a soft layer with a porous structure impregnated with a hard material. Under polishing pressure, the hard material locally deforms irreversibly to a substantially flat polishing pad surface resulting in a polished substrate surface with relatively high planarity and substantially low form error. In an embodiment, the soft layer comprises a polymeric material having a glass transition temperature up to about 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, or 50° C. and the relatively hard material comprises a polymeric material having a glass transition temperature in a range of about 25° C. to 175° C., including 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170 or 175° C. In an embodiment, the relatively hard material is a polymeric material having a glass transition temperature in a range of about 40° C. to about 110° C. Typical temperatures observed during CMP are in a range of about 20° C. to 40° C. The relatively hard polymeric material has a glass transition temperature relatively higher than the ambient temperature during polishing making it brittle and readily friable. Thus, the hard polymeric material is capable of being locally deformed irreversibly to a substantially flat polishing pad surface. In another embodiment, the soft layer is coated

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spots on the polishing pad surface and bubbles under the polishing pad, often resulting in a non-uniform polishing pad surface and inconsistent polishing performance of the polishing pad during CMP. Thus, a need exists for polishing pads that exhibit consistent polishing behavior.

The substrate surface can be characterized by surface features that repeat at a specified distance or spatial wavelength. The overall shape characteristics of the substrate surface can be collectively referred to as "form" of the substrate surface. High and low spots on the substrate surface are often linked to form error, since they represent peaks and valleys on the substrate surface relative to an imaginary reference plane (corresponding to an ideally flat surface), as illustrated in FIG. 1A. Flatness is a measure of the peak to valley range from the imaginary reference plane over long spatial wavelengths. Another parameter to be minimized during CMP is dub-off. Dub-off (also referred to as roll-off in the memory disk industry) is the "negative deviation from the nominal surface extending from the chamfer and continuing to the edge of the flyable zone (International Disk Equipment and Materials Association)", illustrated in FIG. 1B. Two measurements are used to quantify dub-off: peak and radius of curvature. The peak measurement identifies the maximum distance of the polished surface from a fit line designated by the instrument technician. Similarly, the radius of curvature measurement is the distance from the surface being measured to the center of curvature.

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onto a flexible substrate. In an embodiment, the porous structure of the soft layer enables movement of polishing fluid or slurry during CMP. This ability to transport the polishing fluid or slurry enables uniform wetting of the polishing pad of this invention resulting in consistent removal rates.

The pad of this invention is capable of being locally deformed irreversibly to a substantially flat polishing pad surface when the readily friable hard material cracks at the high spots under polishing pressures resulting in a substantially flattened polishing pad surface. Thus, the pad of this invention has a "self-leveling" characteristic or nature which results in a polishing pad that is tolerant to mounting irregularities and can improve waviness and flatness of the polished substrate surface.

The soft material has a porous structure that is either self-supporting or is coated onto a flexible substrate such as a flexible metal film, polyester film, or a foam. The soft layer is impregnated with a hard, friable material. During polishing the substrate being polished (workpiece) flexes the polishing pad so that the hard material cracks and breaks down in any high spots on the polishing pad surface. Further down in the pad surface the flexing is insufficient to cause any disruption to the hard material. Thus, the polishing pad surface becomes substantially flat during polishing creating a "self-leveling" surface. The soft layer controls the final finish of the polished substrate surface while the hard material controls the form error (waviness) of the polished substrate surface.

The "self-leveling" characteristic of the polishing pad of this invention results in a flat polishing pad surface, improving product yields during CMP by reducing aberrations in the surface of the polished substrate or workpiece. Thus, the pad of this invention has the following advantages when used for CMP: 1) elimination of inconsistencies during pad manufacturing and inconsistencies during the process of mounting the polishing pad on a platen of a polishing machine; 2) improved long wavelength roughness; and 3) higher removal rate with minimal scratching of the polished substrate surface. The pad of this invention is used to polish semiconductor devices, silicon wafers, glass disks, LCD screens, memory disks, or the like.

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ing to this invention. In chemical-mechanical polishing of semiconductor substrates, the substrate is pressed against a polishing pad and a polishing fluid or slurry is provided at the interface between the substrate and the polishing pad while the polishing pad and the substrate are moved relative to each other under pressure. Polishing pressure or downforce controls the polishing rate or the material removal rate from the substrate being polished. A higher downforce results in faster material removal rate from the substrate with scratching while a lower downforce yields lower material removal rates but a polished surface of better quality since the abrasive particles in the slurry do not scratch the substrate surface to the same extent at lower downforce values as at higher downforce values. During CMP, the substrate (for e.g. glass disks, semiconductor wafers, multi-chip modules or printed circuit boards) to be polished is mounted on a carrier or polishing head of the polishing apparatus. The exposed surface of the substrate is then placed against the rotating polishing pad. The carrier head provides a controllable pressure (or downforce), on the substrate to push it against the polishing pad. A polishing fluid with or without abrasive particles is then dispensed at the interface of the substrate and the polishing pad to enhance material removal from the substrate surface. Typical downforce values during CMP are in a range of about 0.7 kPa to about 70 kPa.

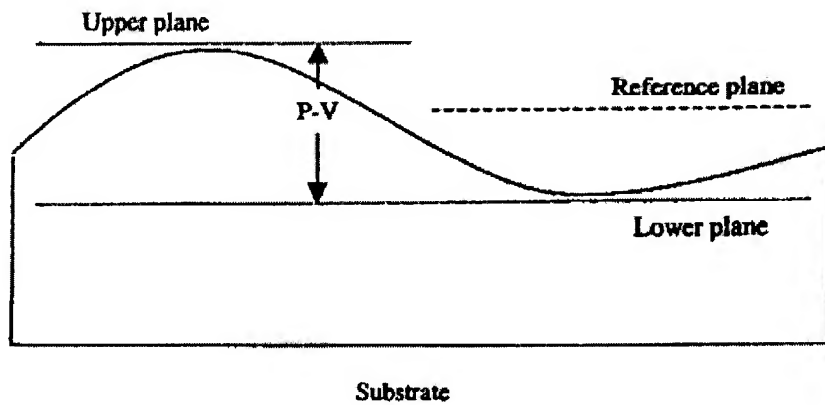


FIGURE 1A

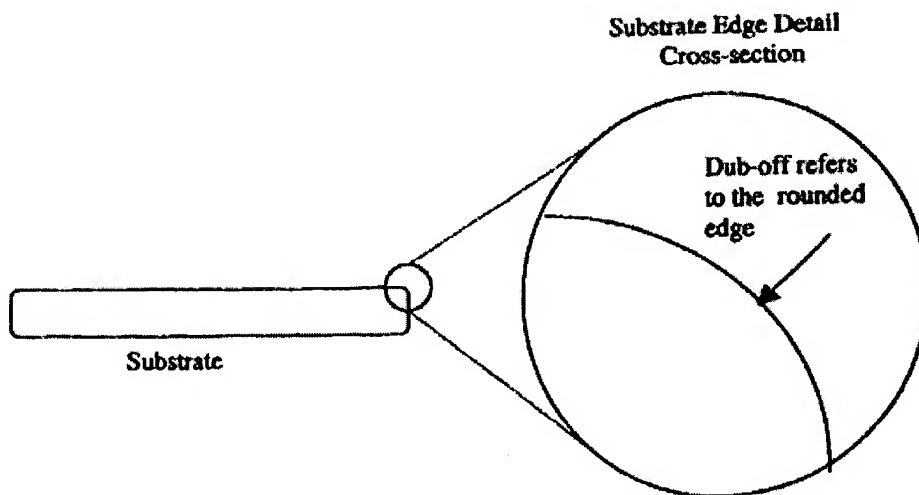


FIGURE 1B

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 8-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker et al.'6,626,740.

Baker has been discussed above, but does not disclose structure topography ranges as well as structure shape after polishing set forth in the claims.

Regarding to claims 13-15, It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized the range set forth in the claims since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

Regarding to claims 8-10, the claims are directed to a result which are not given any patentable weights in the method claims; therefore, the method disclosed in the prior art is capable of producing such shape depending on changing process parameters such as polishing pressure, down force, and velocity.

Regarding to claims 11-12, groove (preshaped asperities) and under polishing pad bump are well-known in the art to provide variable pad stiffness in order to achieve certain polishing conditions to obtain a desired polishing result. Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made

to have utilized these well-known features in order to achieve certain polishing conditions to obtain a desired polishing result.

Regarding to claims 17- 18, the microlens array and optical fiber array connector set forth in claims 17- 18 is the intended workpiece, that is how the limitations further limits the method claim; thus they carry no patentable weights. The method disclosed in the prior art is obviously capable to produce such result.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Please see the attached PTO-892.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Nguyen whose telephone number is 703-308-0163. The examiner can normally be reached on Monday-Friday/630AM-300PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Hail can be reached on 703-308-2687. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

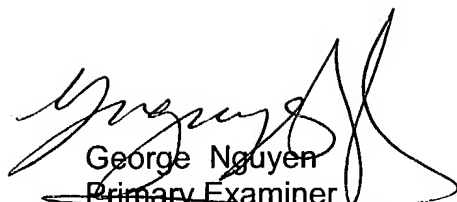
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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George Nguyen
Primary Examiner


George Nguyen
Primary Examiner
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GN – December 02, 2004